

machine, manufacturing 250 kilogrammes of ice per hour:—

A cylindrical tubular copper boiler has a length of 2 metres and a diameter of 35 centimetres; 150 tubes of 15 millimetres traverse its entire length, and are soldered by their extremities to the two ends. This first boiler is the refrigerator. It is placed horizontally in a large sheet-iron vat, which contains 100 tanks of 20 litres each. An incongealable liquid, salted water, is constantly circulating in the interior of the refrigerator by means of a helix. This liquid is re-cooled to about -7° in a normal course, and it licks on its return the sides of the tanks which contain the water to be frozen.

In the space reserved between the tubes of the refrigerator, the sulphurous acid liquid is volatilised, its vapours are drawn up by an aspirating force-pump, which compresses them without the condenser. This condenser is a tubular boiler, the same as the refrigerator; only a current of ordinary water passes constantly into the interior of the tubes to carry off the heat produced by the change of the gaseous into the liquid state of the sulphurous acid, and by the work of compression. A tube furnished with a gauge tap, adjusted by the hand once for all, permits the liquefied sulphurous acid to return into the refrigerator to be subjected anew to volatilisation.

Sulphurous acid has the exceptionally advantageous property of being an excellent lubricant, so that the metallic piston which works in the cylinder of the compressing pump requires no greasing. Thus the introduction of foreign matter into the apparatus becomes entirely impossible.

The work necessary to manufacture 250 kilogrammes of ice per hour is at the most seven-horse power.

A cold of 7° in the bath is amply sufficient to obtain in the tanks a rapid and in every way economical congelation.

With these mechanical arrangements the following important advantages are realised:—1. The pressure never exceeds four atmospheres. 2. There is never any entry of air to fear, the pressures, as far as -10°C. , being always above that of the atmosphere. 3. The volatile liquid employed is perfectly stable, undecomposable, and without chemical action on metals. 4. All greasing in the machine is dispensed with. 5. The volatile liquid is obtained at a very low price, and it is accompanied by no danger of explosion or fire. 6. The cost of production of the ice approaches infinitely near to the theoretic minimum: it is about 10 francs per ton of ice.

By means of all these advantages the practical problem of the manufacture of ice may be considered as solved for all climates, and the process of M. Pictet will not fail to be speedily adopted in all warm countries as soon as it becomes known; it is in such countries that its happy results will be specially utilised and appreciated.

A small specimen of M. Pictet's machine will be shown at the forthcoming Loan Exhibition of Scientific Apparatus at South Kensington.

APPARATUS FOR DEMONSTRATING THE TRANSFORMATION OF FORCE

IN a recent number of the *Journal de Physique*, M. Crova describes a convenient apparatus for showing the relations between heat, electricity, and mechanical force. The arrangement is as follows:—

Two of Clamond's thermo-electric generators are connected in surface, and put in communication with a Gramme machine in such a way as to set this in action. In the circuit is inserted a sort of electric lamp, in which a platinum wire placed in the centre of a small globe (which protects it from agitation of the air) can be raised to incandescence. The only difficulty of the experiment consists in so regulating the length and diameter of the

platinum wire as that it may be raised to a red heat, while the thermo-electric current retains sufficient intensity to drive the Gramme machine. A circuit entirely metallic then is obtained, with which the following transformations can be effected:—

1. The Gramme machine being excluded from the circuit, a portion of heat, transformed into electricity by the thermo-electric pile, reappears in the state of heat in the platinum wire.

2. The platinum wire being excluded from the circuit, and the Gramme machine introduced, a portion of heat, transformed into electricity in the pile, produces mechanical work in the machine, which acts as a motor.

3. The platinum wire and the machine being included in the circuit, a part of heat, transformed in the pile into electricity, produces heat in the wire and work in the motor. If we then stop the motion of the Gramme machine, we find the incandescence of the platinum wire increased. The machine being liberated, on the other hand, is set agoing again, and the incandescence of the platinum wire diminishes in proportion as the motion is accelerated. In this way is rendered sensible to the eye the expenditure of heat necessary to develop an increasing quantity of mechanical work.

4. Taking the handle of the machine, we turn it in the direction of the rotation the current produces, but with an increasing velocity. In this way a velocity is reached such that the incandescence of the wire *completely disappears*.

5. If the handle be turned in a direction opposite to that of the rotation the current communicates, there is considerable resistance, and the incandescence of the wire *increases* rapidly; on turning more quickly, the wire is fused. Thus, in the metallic circuit under consideration, the circulation of a given quantity of energy may appear exteriorly in the form of heat or of mechanical work, the one of these quantities being the complement of the other. If by an exterior force we introduce into the circuit an additional quantity of work, the increase of the quantity of energy put in circulation is rendered visible by the incandescence of the wire; any communication outwards from the circuit, of a certain quantity of energy which circulates in it, appears, on the other hand, in diminution, or even disappearance, of the incandescence.

NOTES

LORD SALISBURY, on Monday, named the following as Commissioners under the Oxford University Bill:—Lord Selborne (Chairman), Lord Redesdale, the Dean of Chichester, Mr. Mountague Bernard, Sir Henry Maine, Mr. Matthew White Ridley, and Mr. Justice Grove. The feeling among scientific men is one of intense disappointment, leading to the conclusion that it is useless any longer to consider whether Oxford will ever be in a position to do anything for the promotion of science.

THE report of the Cambridge Board of Mathematical Studies to the Studies' Syndicate contrasts with the reports of most of the other boards in the paucity of its suggestions for improvement. They do not seem to think that very much is required in order to perfect the system of mathematical teaching. They believe in the probable stability and development of the system of inter-collegiate lectures, but say very little to assist its development, and they say nothing about the present vehement competition by means of private tuition, and the defective method of study that it induces. In answer to the question how University teaching may be organised so as to give the greatest encouragement to the advancement of knowledge, "the Board offer no suggestions under this head." Is this quite what might have been expected in a report bearing the signatures of Stokes, Cayley, Adams, Clerk-Maxwell, Sir W. Thomson, Tait, Lord

Rayleigh, and James Stuart? May there not be some unobvious explanation of this phenomenon? The whole report consists of only forty-one lines.

THE *Daily News* of Thursday last contains a letter from its *Challenger* correspondent, giving an account of the voyage from Valparaiso to Monte Video between December 10 and February 16. Most of the work of this cruise was done among the islands on the South American coast between the Gulf of Penas and the Straits of Magellan, and at the Falkland Islands. A considerable number of soundings were taken, and successful hauls made; the naturalists landed on several islands and made collections of specimens. This is the first part of the last section from Valparaiso to England, when the work of the ship will be completed.

MR. W. Spottiswoode, F.R.S., has been elected a corresponding member of the French Academy of Sciences, in the Geometrical Section.

ON the 21st inst. a fine bronze statue of the late Lord Rosse, erected in the principal street of Parsonstown, was unveiled. It is described as one of the latest and best of Foley's works.

GEOLOGICAL Time was the subject of Prof. McKenny Hughes' lecture at the Royal Institution on Friday evening. He told the audience that "A wise man before building a structure first examined the nature of the foundation," and he then proceeded to inquire into the nature of the evidence upon which the calculations have been made, as to the rate of denudation of valleys, the wearing back of sea coasts, the growth of peat-mosses, and the deposition of alluvium. He endeavoured to show by means of examples of exceptional phenomena, happening at long intervals and lasting for indefinitely short periods, that such calculations were utterly fallacious, and concluded by comparing our position to that of a "man in a cockle-shell boat, trying to sound an almost unfathomable ocean, firstly, with too short a line; secondly, with too heavy a weight; and lastly, with a weight so light that he was perfectly unaware when he touched the bottom." "To doubt," a great biologist tells us, "is the first principle of modern science," but in life, as in art, there are lights as well as shadows, and geological time is so intimately connected with the history of life upon our globe, and with the knowledge we possess of past denudations that have produced those missing leaves in the chapters of the earth's life history that geologist's call unconformities, that we venture to think that though we may not have reached the bottom of the deeper oceans, yet we have certainly sounded some of the most shallow seas. We therefore look forward with pleasure to hearing another lecture from Prof. Hughes, in which drawing on his abundant resources, he will leave the negative for the positive, the unknown for the known, and show us step by step the lights modern science has already thrown on the great cosmical, physical, and biological changes that are involved in the term "Geological Time."

AT the meeting of the Vienna Geological Society, on March 7, Mr. Hauer read a letter dated Manila, Jan. 11, 1875, from Dr. Drasche, who has been staying at the Philippine Islands since December 8 last, and intends to remain there for about six months longer for the purpose of investigating the active volcanoes and obtaining some knowledge of the geological composition of the island of Luzon. Four considerable excursions have been already made—1. To the plain of Pampanga, with the ascent of the Arayat and the Cordillera of Zambales. 2. The southern shore of the Laguna de Bey, ascent of the extinct volcano Maquillin, and a visit to the solfatara Tierra Blanca. 3. Ascent of the volcano Tael. 4. River Poray and Cueva de San Mateo. The wide fertile plain in which Manila lies is composed of clay strata recently raised from the sea, abounding

with such species of fossils as are still living in the neighbouring sea. The plain is bordered by a range of hills, consisting of pumice-tuff. On the higher mountains behind these there are found trachytes and andesites, besides the tuffs. Of special interest among these is an amphibole-andesite, containing a great deal of olivine, that composes the Arayat. It is the most basic eruptive rock that Dr. Drasche has noted as yet on the isle of Luzon, and belongs probably to a more ancient volcanic period. On the Arayat, which had been hitherto considered as an extinct volcano, neither eruptive matters nor any other signs of distinct volcanic action are to be discovered. Near the River Poray there were found, besides greenstone-trachytes and conglomerates, large masses of a white limestone, partly crystalline and containing fossils, chiefly fragments of corals. When Dr. Drasche despatched his letter he was about to undertake a journey of two months to the wild northern regions of Luzon that have hardly ever been visited by geologist as yet.

DR. PARKES, whose death at the comparatively early age of fifty-six years we announced last week, was a man whose loss will be felt in many circles of society; he had connections with many scientific bodies, and, we believe, was universally known, beloved, and admired in the medical profession, for the scientific advancement of which he did so much. He served the State in various capacities throughout his life, but is specially known in connection with the Army Medical School, which owes a great part of its efficiency to his exertions and example. He had had a good training in scientific investigation, and his application of the principles of science to the conduct of research in his own department led to valuable results. Dr. Parkes was elected a Fellow of the Royal Society in 1861, and his contributions to its proceedings have been numerous and of high value. Among these we may mention his three papers on the Effects of Diet and Increase in the Elimination of Nitrogen during Muscular Action; in 1870, 1872, 1874, he also contributed papers on the Effects of Alcohol on the Human Body. Dr. Parkes, indeed, seems to have been a model of what a scientific physician should be, and to this he joined a character that attracted the love of all who knew him.

LETTERS received in Sydney from Signor D'Albertis, the Italian naturalist, we learn from the *Times*, who has been for some time resident on Yule Island, on the coast of New Guinea, give further accounts of the belt of coast land, twenty to twenty-five miles in width, of which he is able to speak, and so much of the land beyond this limit as was visible from the summit of a hill about 1,200 feet high. From this eminence he saw a large extent of plains, indented with lagoons, with the River Amama (the Hilda of the *Basilisk*) flowing downward from a northerly direction to its junction with the Nicura, which discharges its waters into the sea. Apparently, this stream is deep enough to be navigable far into the interior, but its channel is seriously obstructed by fallen timbers. He ascended the Nicura River for a distance of eighteen or twenty miles, and found it fringed with mangroves for the first ten miles, after which these gave place to splendid thickets of the Nipa palm, while the eucalyptus and the grass tree flourish at some distance from the stream. He crossed the Amama several times, and describes it as flowing through a large and fertile valley, apparently uninhabited, and well adapted for pastoral purposes. Nowhere did he find the natives possessing any knowledge of gold, silver, or any other metal. He confirms what has been said by Mr. Wallace and other travellers as regards the island being peopled by two races, the one mentally and physically superior to the other; the invaders having driven the indigenous tribes into the interior. The earlier inhabitants of New Guinea have darker skins than their conquerors, are shorter in stature, and their countenances are more prognathous than those of the coast tribes. The western

side of New Guinea appears to be chiefly inhabited by the indigenous Papuans, and the eastern by a superior race.

THE mail steamer *Congo* arrived at Madeira on Saturday with Lieut. Cameron on board; his health is perfectly restored. The *Congo* left Madeira the same afternoon, and is expected to arrive in England during the present week. Sir H. Rawlinson announced to the Geographical Society on Monday that it is proposed that Lieut. Cameron should appear at the next meeting of the Society, and as it is expected that the audience will be unusually large, the meeting will be held in St. James's Hall on Tuesday week, April 11.

AT the last meeting of the Geographical Society Capt. Anderson, R.E., read a paper on "The North American Boundary from the Lake of Woods to the Rocky Mountains." Capt. Anderson was chief astronomer of the North American Boundary Commission.

THE most important paper in the last (February) part of the *Bulletin* of the French Geographical Society is the first part of Dr. Nachtigal's account of his travels in Central Africa in 1869-74. M. H. Duveyrier has a paper on Lieut. Cameron's trans-African journey, and the account of Abbé David's second exploring journey in the West of China, and M. J. Codine's paper on the Portuguese discoveries on the Western African coast in 1484-8 are continued.

WE have received the first number of *La Revue Géographique Internationale*, whose proposed fortnightly appearance we announced recently. It is a well-printed quarto of sixteen pages, and starts with a very promising programme. The most notable paper is on Ancient Geographical Monuments of the Tenth and Eleventh Centuries, by M. E. Cortambert, being a notice of the principal maps of that time which have reached us. Under the heading of "Courriers de l'Extérieur" letters from correspondents in various parts of the world are published.

INTELLIGENCE from Kasan announces that the German Exploring Expedition to Western Siberia has arrived there.

THE state of Mount Vesuvius was reported by the *Daily News'* correspondent on Sunday to have been unchanged. Prof. Palmieri wrote from the Observatory on Saturday: "Smoke is still abundant. There is a reflected glare at intervals from the fire within the crater. No lava has yet made its appearance." No immediate eruption is, however, expected.

THE annual meeting of the Iron and Steel Institute was commenced on Tuesday in London, and will be concluded on Friday. The Bessemer Medal for 1875 was presented to Mr. R. F. Mushet. To-day the Council will be entertained at dinner by the Lord Mayor, at the Mansion House.

M. FRIEDEL, an able mineralogist, has been appointed Professor to the Museum of Natural History of Paris, to fill the place vacated by the retirement of M. Delafosse. It is to M. Delafosse that is due the admirable arrangement of the Gallery of Mineralogy in the Museum.

THE Lords of the Committee of Council on Education have given directions for a course of instruction in Botany to be delivered at South Kensington, commencing about the middle of June, 1876. This course will be given by Prof. Thiselton Dyer, M.A., B.Sc., &c. It will consist of a daily lecture, with practical instruction in the Laboratory, and will extend over about eight weeks. A limited number of Science Teachers, or of persons intending to become Science Teachers, will be admitted to the course free of expense. They will also receive their travelling expenses to and from London, together with a maintenance allowance of 30s. per week while attending the course. The hours of attendance will be from 10 A.M. to 4 or 5 P.M.

A "VICTORIA and Albert Palace Association" has just been formed. It is intended, if the consent of the Government can be obtained, to build a palace on the banks of the Thames, near Battersea Park, for the "health, recreation, and instruction of the metropolis," combining "the amusements of the Crystal Palace, the pleasures of the Albert Hall, with the instruction and benefits furnished by the Kensington Museum." It is hoped that the palace will be opened on May 1, next year.

AN International Exhibition is to be held in Paris in 1878 or 1879 at latest.

THE *Bulletin de la Société des Sciences d'Alger* for 1875 contains interesting papers on the ethnology of the Barbary races, by M. J. A. N. Perrier; and the geography, ethnography, geology, zoology, and archæology of Algeria, by Prof. Jourdan. Meteorological tables are appended, giving the observations made from three to five times daily, the barometric observations being made unfortunately with an aneroid, by which their value is much lessened.

A COURSE of Twelve Lectures on Geology, free to the public, will be delivered in the large hall of the London Middle Class School, Cowper Street, Finsbury, on Tuesday and Friday evenings, at eight o'clock, commencing April 4, by Dr. W. B. Carpenter, C.B., F.R.S.

PROF. RUBENSON has published in the *Transactions* of the Royal Academy of Sciences at Stockholm, a discussion of the rainfall of Sweden, with five plates, from the observations made at twenty-nine stations from 1860 to 1872. From this discussion we learn that Göteborg is the wettest, and Kalmar the driest station; that in advancing from S.W. to N.E. the line of maximum precipitation passes from Göteborg to near Gefle, and that as regards seasonal distribution, the maximum is assimilated to that of continental Europe, occurring generally in July and August, and the minimum to that of the eastern part of Great Britain, south of the Grampians, occurring in March and April. Two valuable tables are added, one giving the monthly means at places at which long-continued observations have been made, and the other the annual averages for the twelve decennial periods, beginning with 1751.

IN the *Bulletin International* of the Observatory of Paris, P. Denza gives an interesting notice of a comparison of the barometers at fifty-five of the Italian stations, made by him during 1870-75. The comparison was made in each case with the normal barometer of the Observatory at Moncalieri, whose error had been ascertained by comparison with the standard of the Paris Observatory through that of the Observatory at Turin.

WE have received the meteorological observations made at the Naval Hydrographic Office at Pola for January last. This number is the first of a new series giving the hourly observations of the barometer, thermometer, and anemometer, including both direction and force of wind, together with the daily and hourly averages for the month. The position of Pola on the comparatively confined basin of the Adriatic gives a peculiar value to these hourly observations.

IN the *Quarterly Journal of the Meteorological Society* appear, among other matters, a paper on the rainfall at Calcutta for the twenty-eight years ending with 1874, by Mr. R. Strachan, in which the main facts are carefully summarised and tabulated in a useful form; a description of a self-regulating atmometer, by Mr. S. H. Miller; and a short paper by Mr. William Marriott, on the reduction of barometric observations, with a table for combining the corrections for index error, temperature, and altitude. The table will facilitate the work of reduction, and is sufficiently exact for most practical purposes for which such tables are required, and may be used in preparing observations and means for the press, provided the observations and means themselves be also printed uncorrected for height.